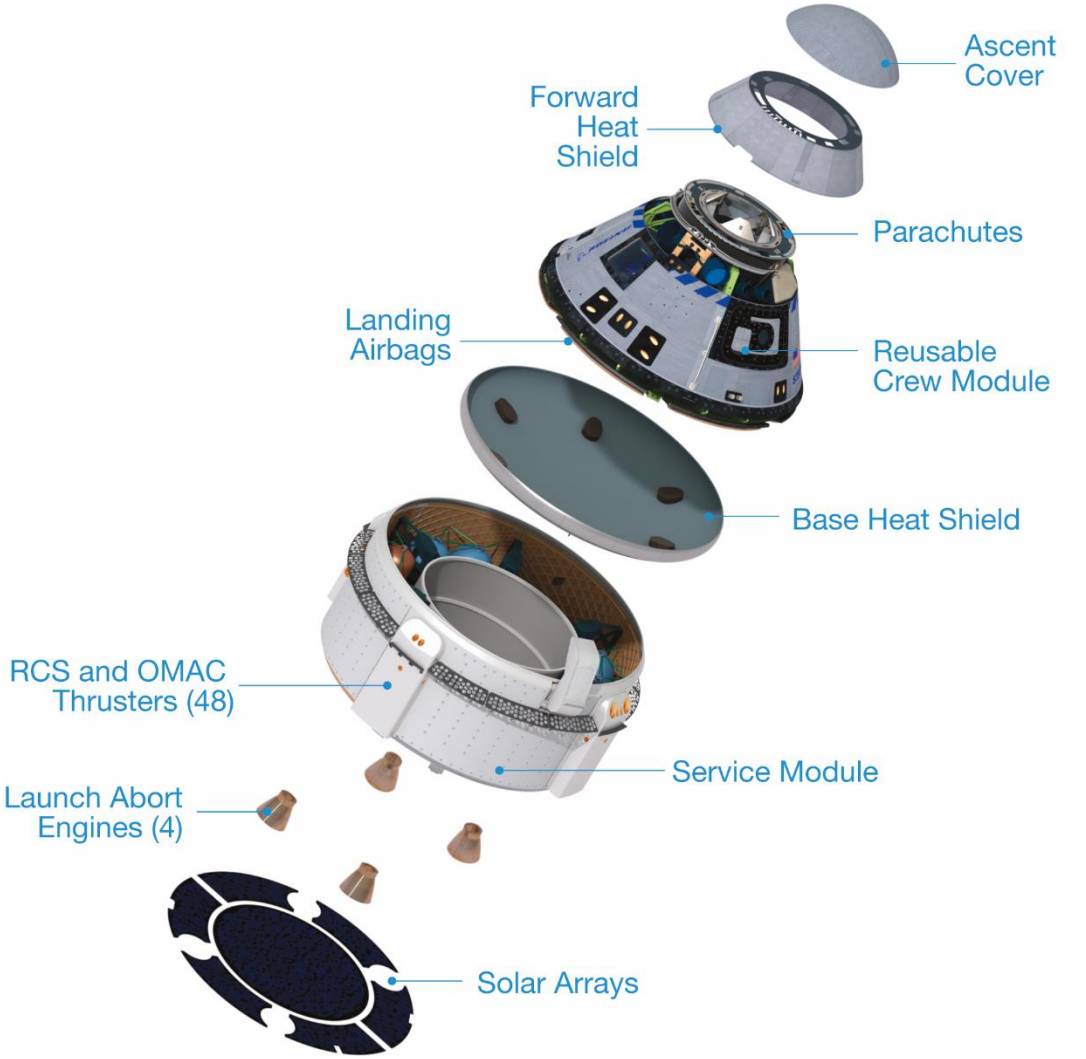
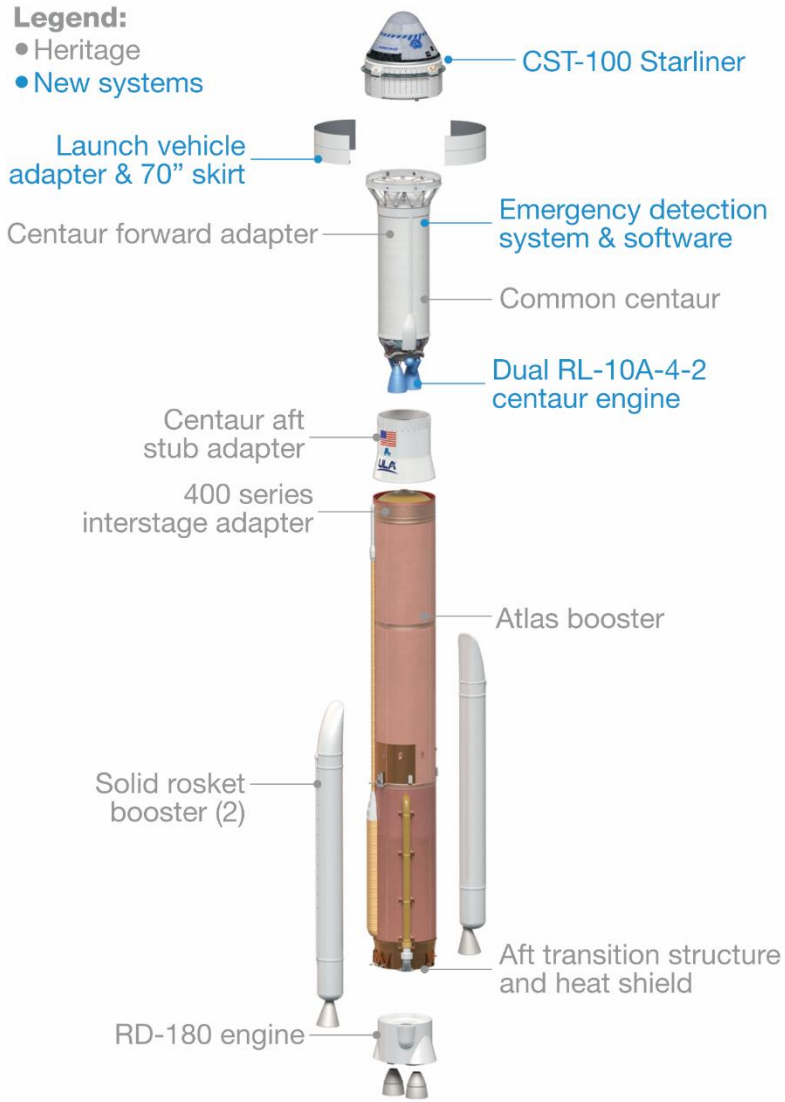

BOEING
CST-100
STARLINER
Boeing Commercial Crew Program
Cochise County Board of Supervisors Update
March 2021

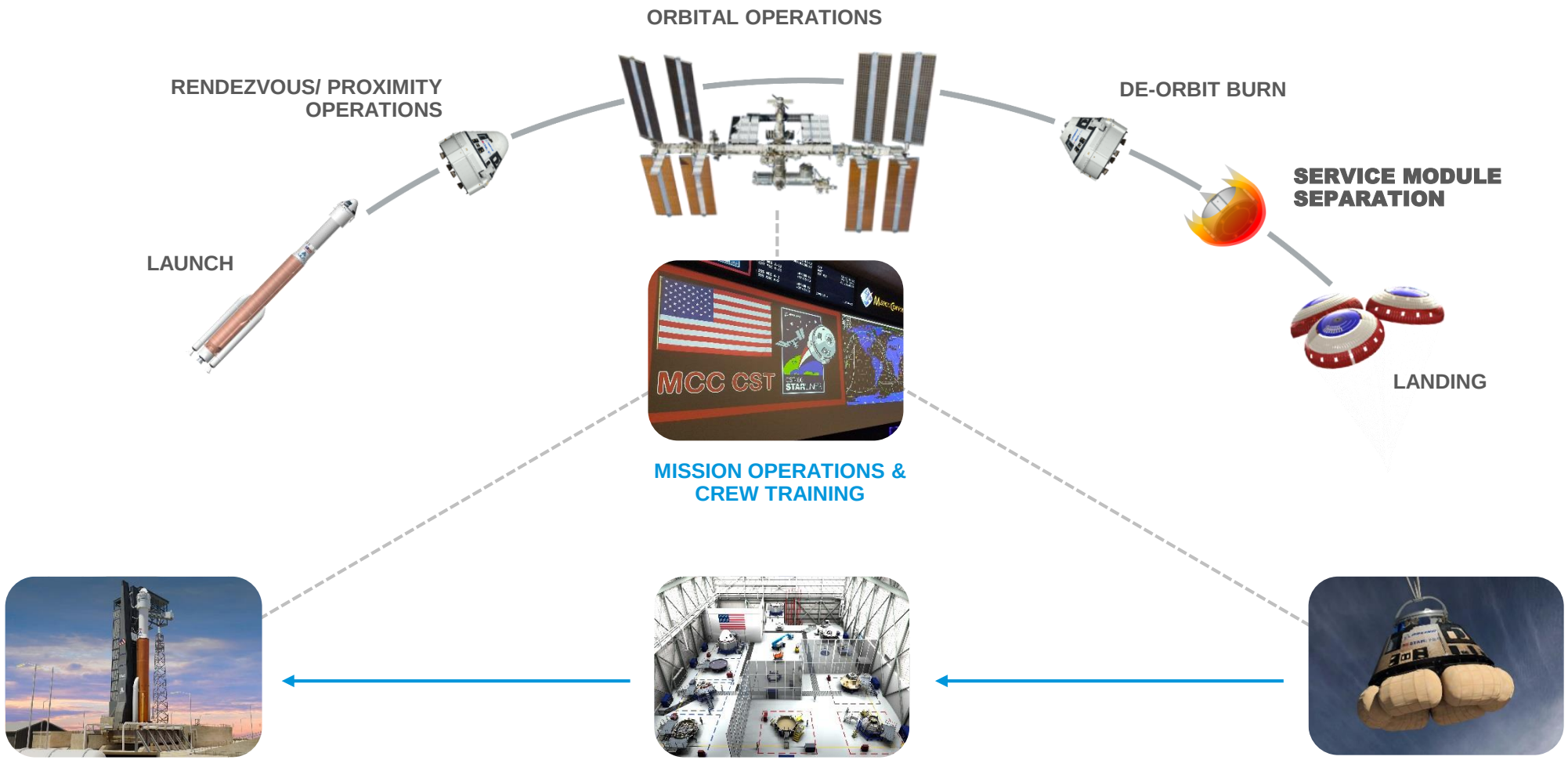
BOEING CST-100 STARLINER SPACECRAFT



UNITED LAUNCH ALLIANCE ATLAS V "N22" LAUNCH VEHICLE



MISSION OVERVIEW



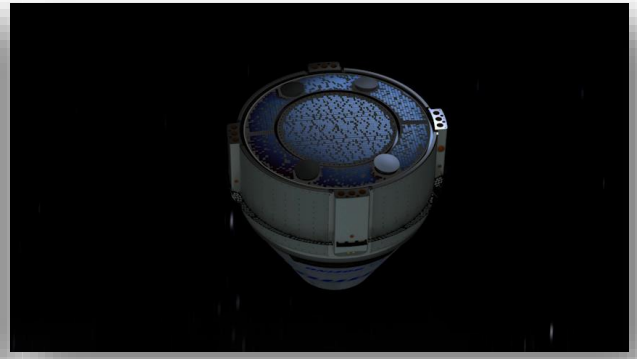
Crew Training

Ground Support and Mission Operations

Launch, Ascent and Spacecraft Separation

Orbital, Rendezvous and Proximity Operations

Docking and Undocking



CM/SM Separation, Reentry and Landing

Recovery and Post-flight Processing

Parachute Drop Tests

Land Landing Systems Qualification

Hot Fire Testing

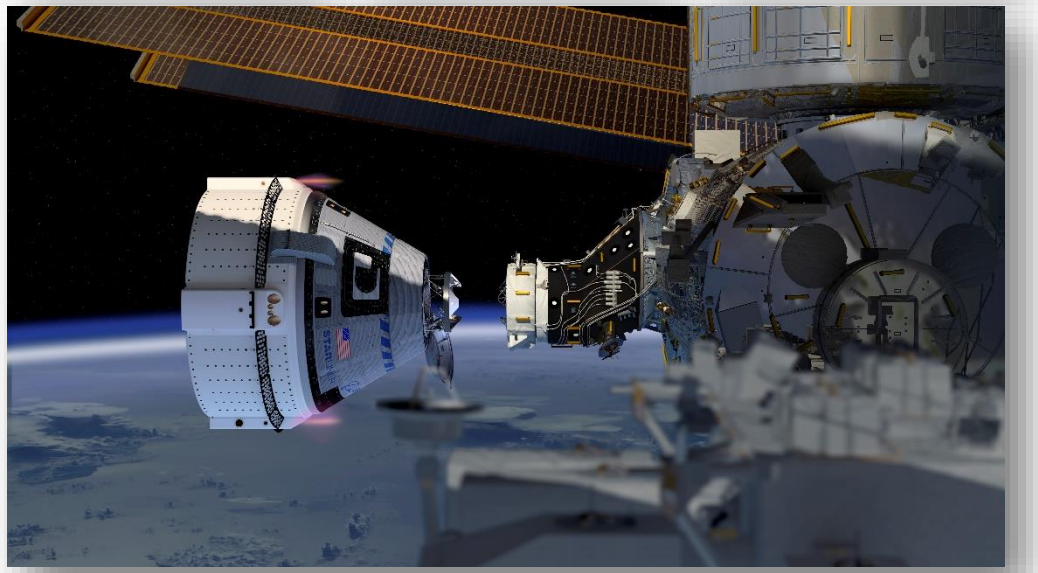
Structural Testing

Environmental Qualification Testing

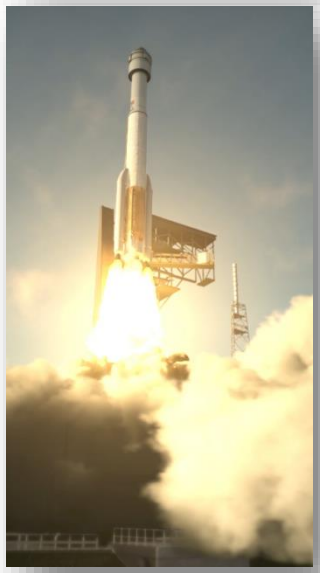
COMMITTED TO CREW SAFETY: SUCCESSFUL PAD ABORT TEST

Orbital Flight Test

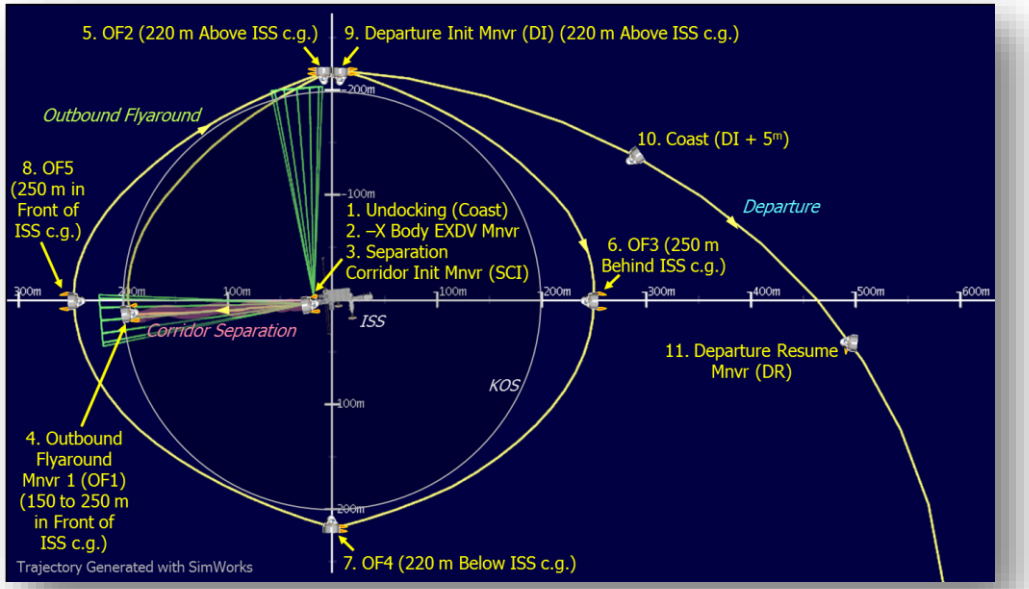
Crew Flight Test



Post-Certification Missions



MISSION DETAILS: UNDOCK, DEORBIT AND REENTRY



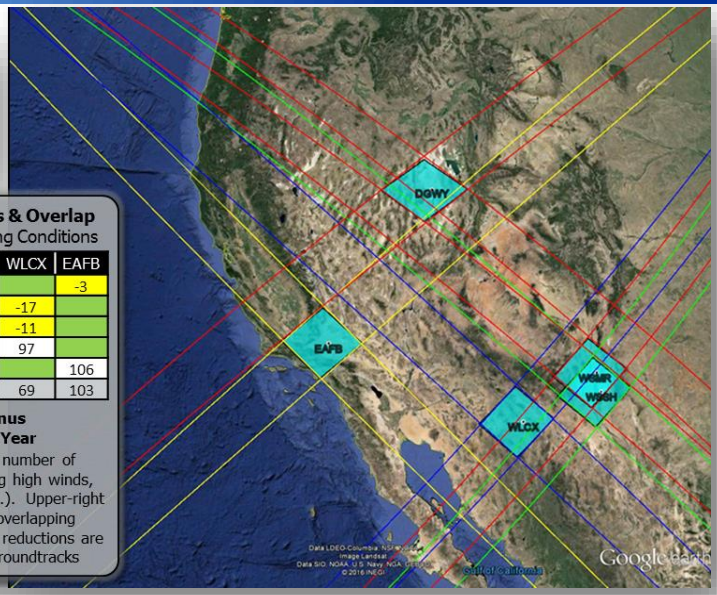
Crossrange from 400 km
(L/D = 0.3, C.G. = 6.15 in)
- Ascending Left = 83 km
- Ascending Right = 119 km
- Descending Left = 115 km
- Descending Right = 86 km

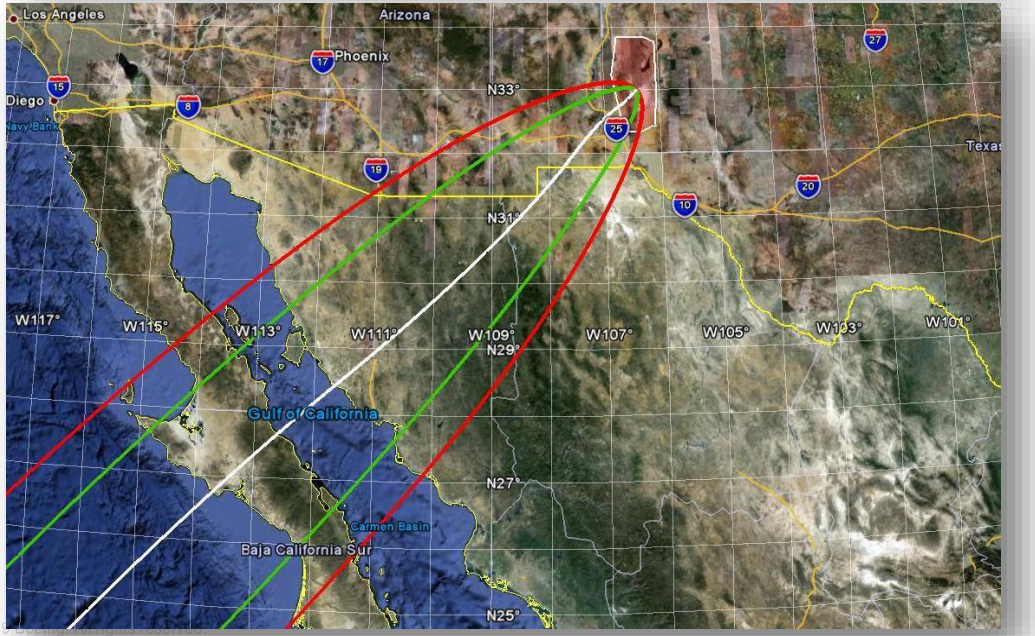
Total Landing Opportunities & Overlap
Regardless of Weather & Landing Conditions

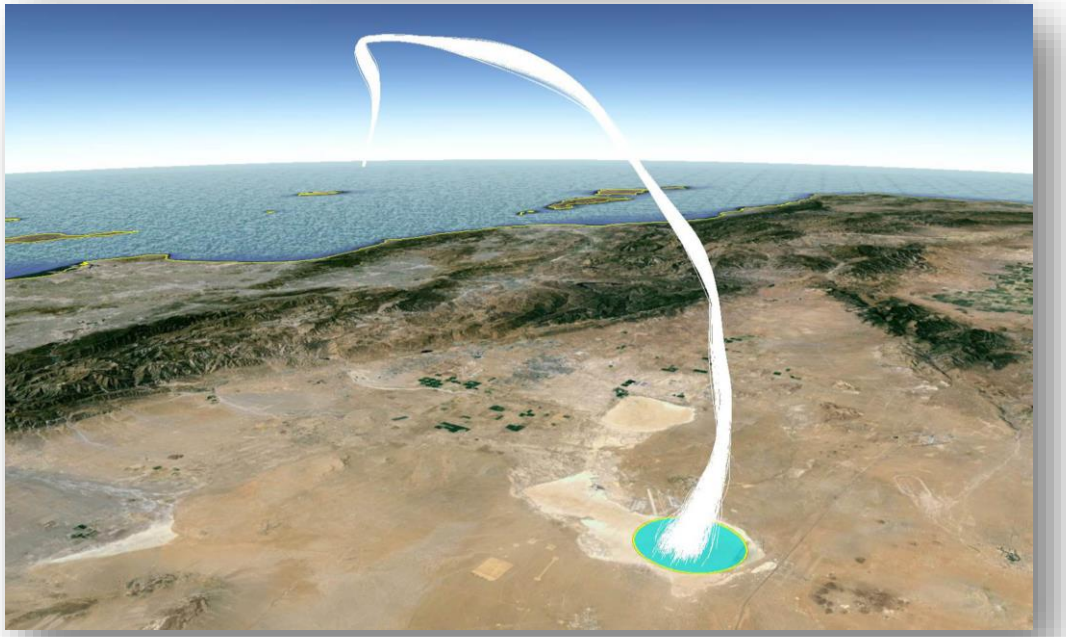
	DGWY	WSMR	WSSH	WLCX	EAFB
DGWY	128				-3
WSMR	-16	101	-33	-17	
WSSH		-37	96	-11	
WLCX				97	
EAFB					106
Net	112	64	63	69	103

Total Opportunities Minus Overlaps = 411 Net per Year

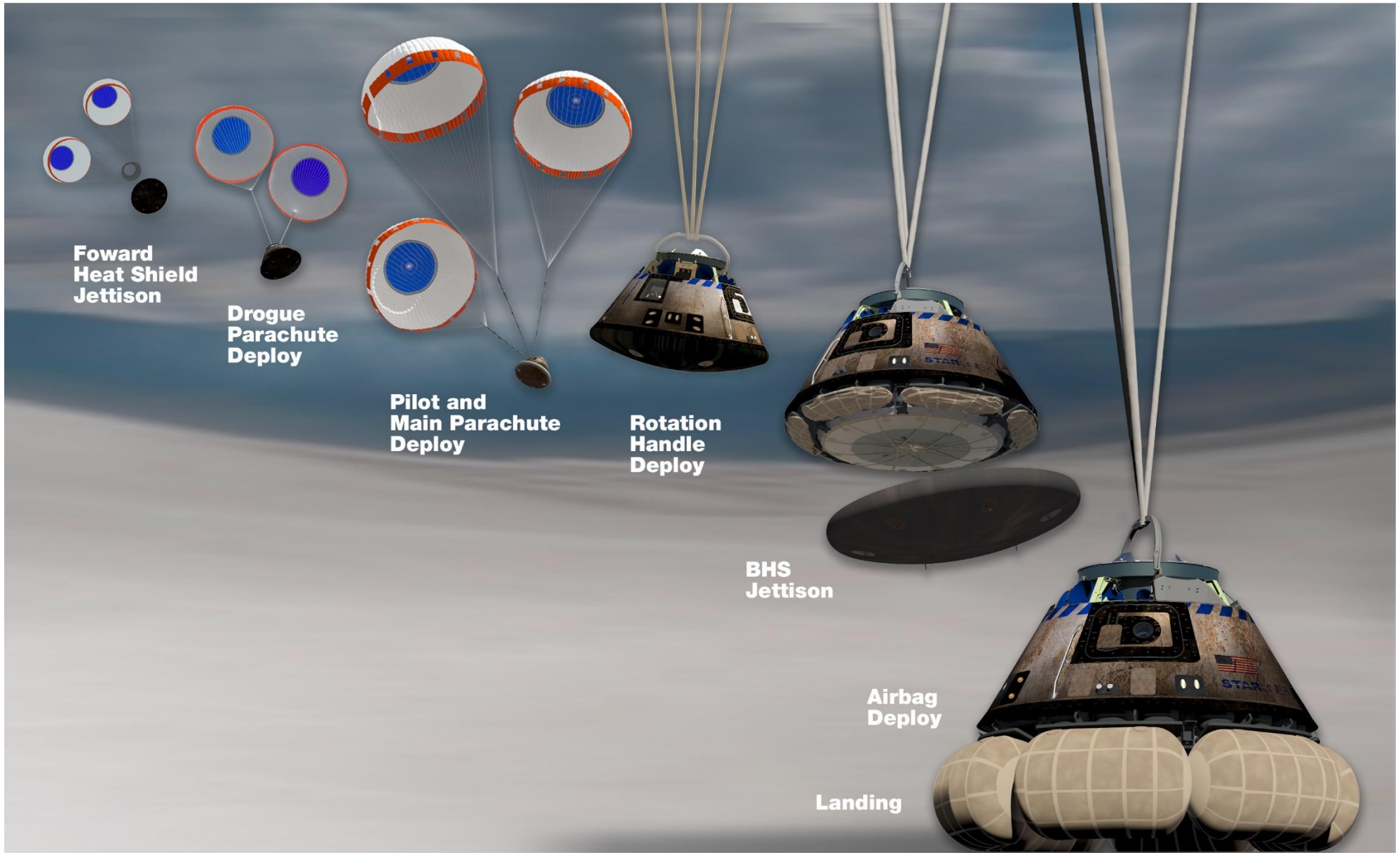
Values on the diagonal are total number of opportunities to each site (including high winds, excessive precipitation, ponding, etc.). Upper-right reductions in yellow are due to overlapping ascending groundtracks. Lower-left reductions are due to overlapping descending groundtracks





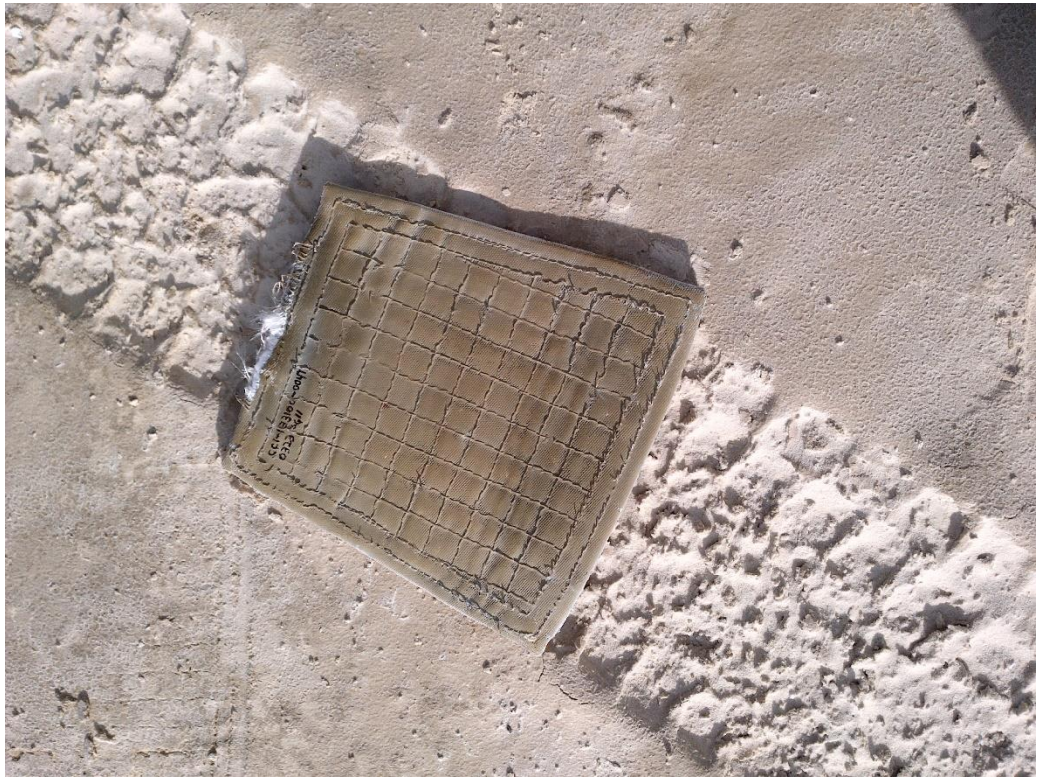


MISSION DETAILS: LANDING



JETTISONED PARTS – KEYHOLE EXTENSION

Mortar Lids - 2 sizes:
7.4 in. diameter/4 oz.
16 in. diameter/12 oz.

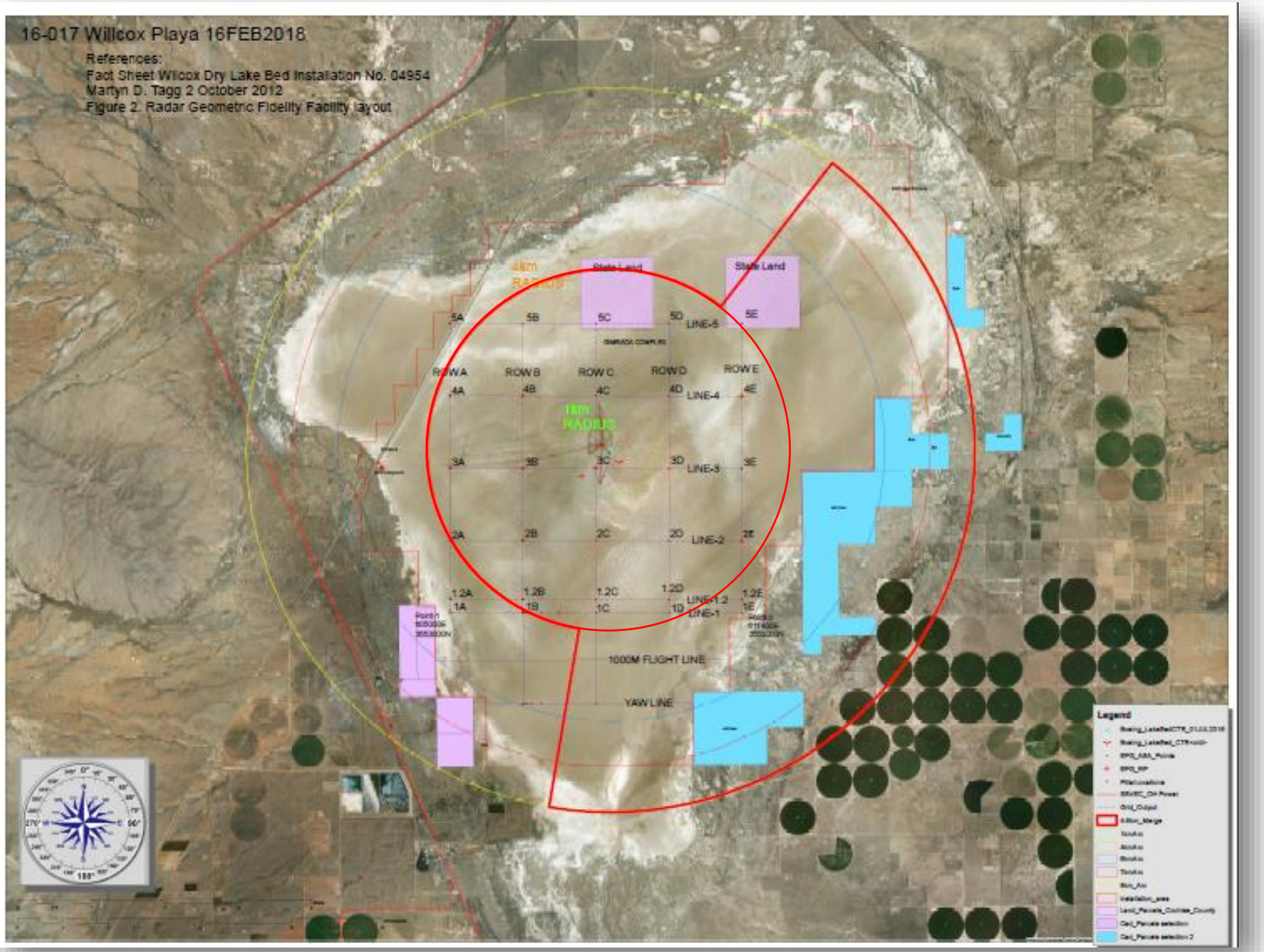


Forward Heat Shield Door
10X12 in./1 lb.

- **Nominal**
  - Planned end of mission landing approximately 6 months after launch
  - Dates and primary and backup landing sites normally picked approximately 30 days prior to landing (dependent on ISS altitude, trajectory, crossrange, weather and Range environment)
  - Full Boeing equipment and team available at prime site and a smaller team at the backup site about 7 days prior to landing
    - Some core team members travel from prime to backup, if a wave off occurs
    - Approximately 24 hour notice if wave off from prime to the backup site

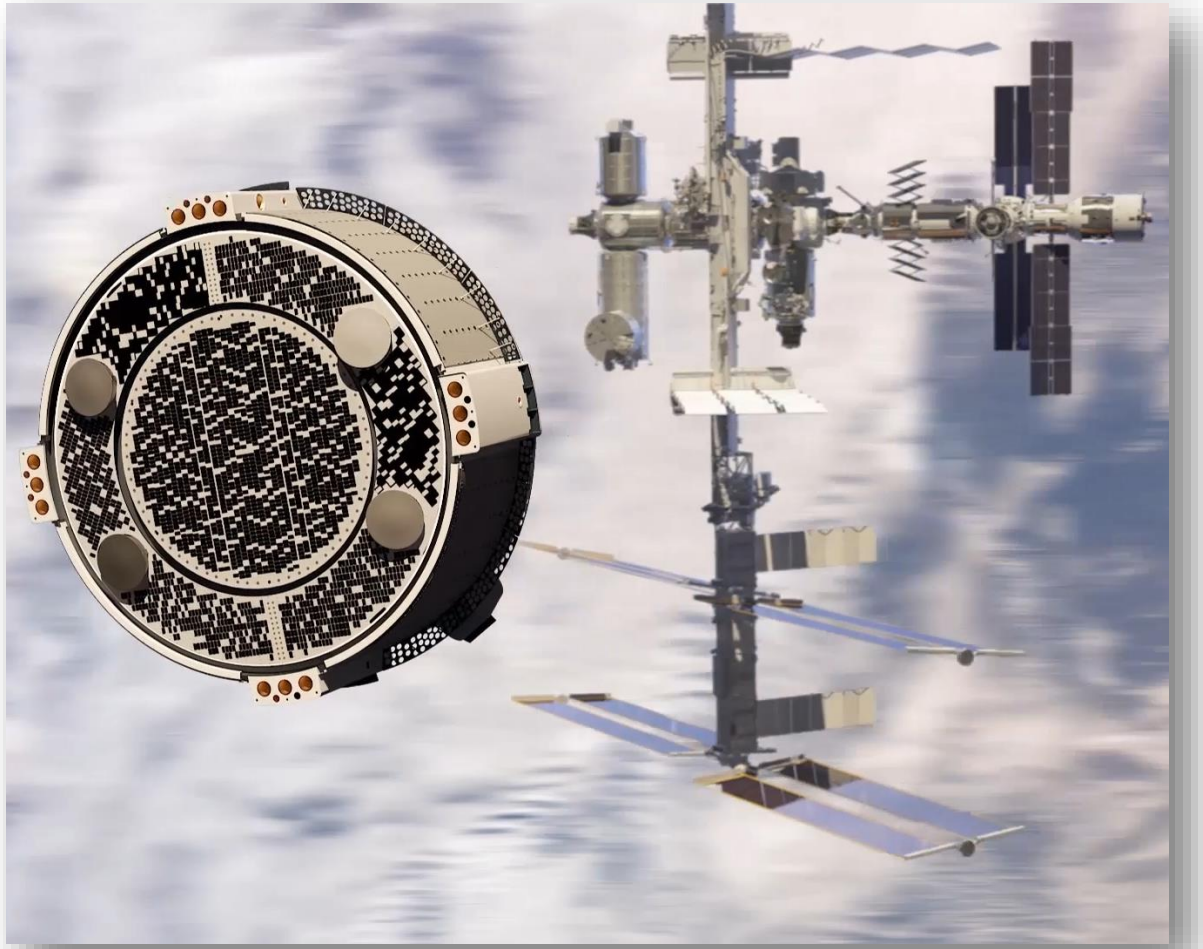
- **Emergency**
  - Three possible causes
    - Space Station issue requiring the crew to undock from the Station
    - Starliner issue that puts at risk its ability to stay in orbit
    - Crew medical issue
  - Minimum time between declaring an emergency return and landing is about 4 hours
    - In most cases, the Starliner flight operations team will maintain the spacecraft on-orbit for as long as possible in order for the core Boeing team to travel to the site, but the most important factor is the availability of a land landing site
    - Requires plan for minimal-to-no Boeing support, in case ASAP return needed to protect for loss of vehicle and/or crew

WILLCOX PLAYA LANDING ZONE



Starliner is Step One

- NASA-Boeing Partnership is Foundation
  - Streamlining Starliner training and operations
    - The mission is about destination
  - Defining private space fliers on ISS
- ISS is Commercial Proving Ground
  - Focus on increasing commercial utilization
  - 5th seat passengers
    - Sponsored commercial fliers
    - Non-international partner government astronauts
    - Private Citizens
  - Standalone commercial flights
- Commercial Partners Required
  - Starliner is full-service LEO human transportation system
  - Destinations needed for long-term sustainability
  - Increasing mission cadence creates economies of scale

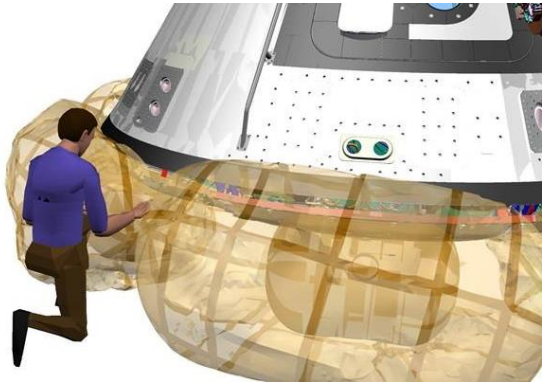


MultiRAE

MultiRAE (Hydrazine)
Handheld hydrazine monitor, used by Gold Team for initial safety check near the CM thrusters

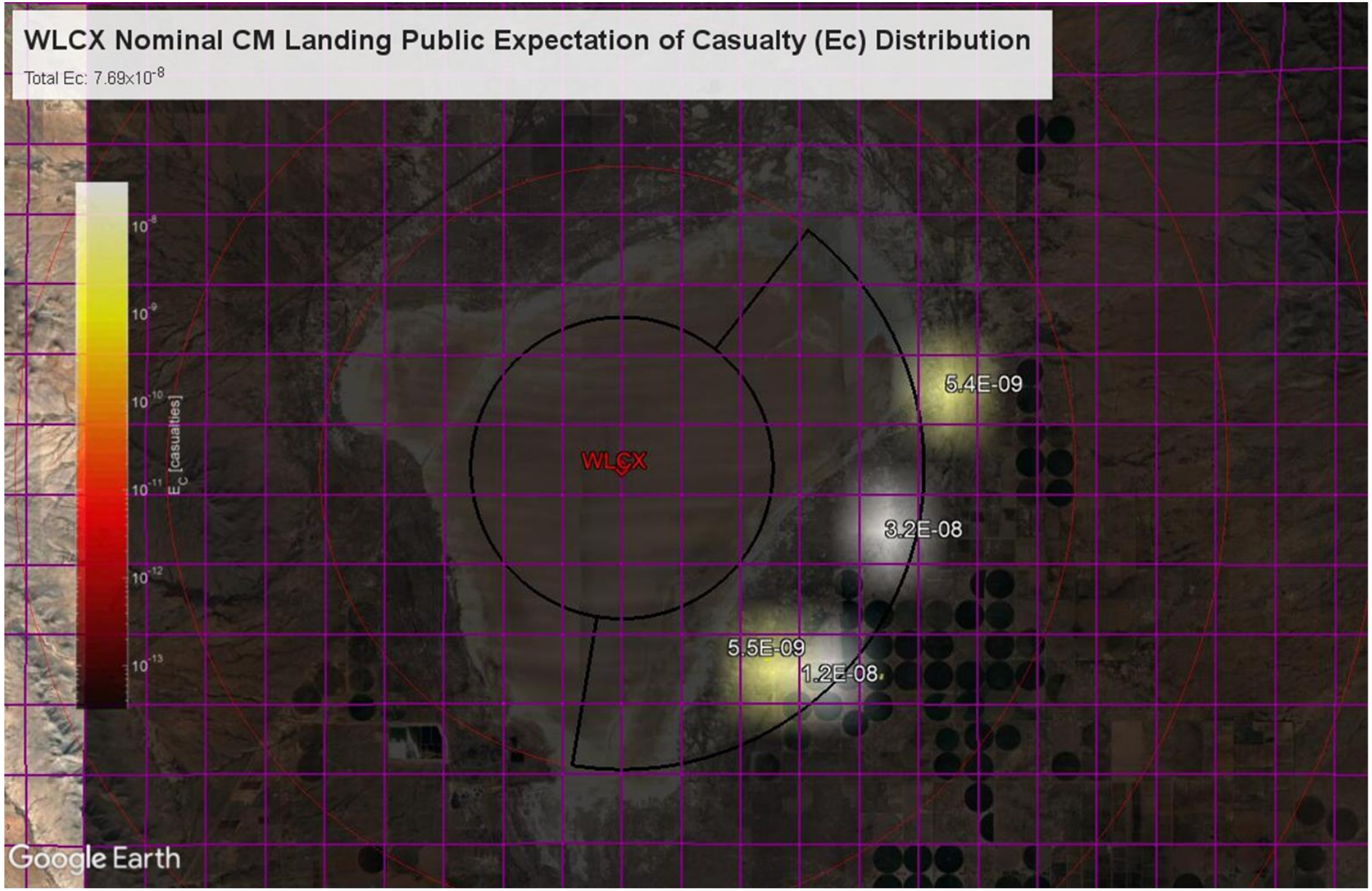
Grounding Kit includes 6-6ft. Grounding Rods

Fluke Meter



- Boeing has added Starliner landings to a contract with Clean Harbors for hazardous waste cleanup
  - Clean Harbors crew will be on site the day before, the day of, and the day after the landing
  - Will be responsible for decon of equipment affected by any hydrazine leaks
  - Will transport and dispose of any waste generated from the decon process

- Boeing has established wind limits for landings at Willcox Playa
  - All large parts must be projected to land within the 4km radius landing zone.
  - Per agreements with NASA, FAA, and Ft. Huachuca, up to six small jettisoned part may exceed this 4km radius but must remain within an 8km radius wedge between 38^0 and 190^0 true north
- Ft. Huachuca will launch weather balloons beginning at landing -24 hours
  - Mission Operations personnel will use balloon and forecast data to forecast weather conditions at landing
  - Data used in model to determine projected landing box for each jettisoned part
  - Location of landing boxes will determine go/no-go for landing



Collective Ec: The total combined risk to all individuals exposed to one or more particular hazards during a specific period of time or event (a specific phase of flight).

Unless otherwise noted, collective risk for a range operation is the mean number of casualties expected (E_c) during an established period (e.g., landing) due to the combination of all hazards associated with the operation.